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Lack of Knowledge of the relationships

PROBLEM 1

LACK OF KNOWLEDGE OF THE RELATIONSHIPS AMONG WILDLIFE COMMUNITIES, HABITAT TYPES, AMOUNTS, PATTERNS, AND SERAL STAGES IN ASPEN STANDS

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INTRODUCTION

Quaking aspen (Populus tremuloides) stands comprise over 2 million hectares of montane and subalpine forests in the central Rocky Mountains (DeByle in press). Most of this aspen is present in National Forests, sometimes forming islands surrounded by grassland, or more typically, interspersed with extensive coniferous forest (Morgan 1969). Aspen is important habitat for many wild birds and mammals (DeByle in press) and may be essential for some species (e.g., cavity-nesting birds). Aspen forests also produce abundant forage and shelter for livestock, and serve as firebreaks and sources of water runoff. Recreational sites have been established in aspen forests, and aspen is valued for its scenic beauty. A large variety of wood products can be manufactured from aspen, including paneling, pallets, paper, particle board, flakeboard, and speciality products such as posts, shingles, and matchsticks (Beetle 1974, Wengert 1976 a,b). The high moisture content, rapid decay, and small size of aspen makes the cost of logging and manufacturing high (Wengert 1976b), and therefore the market demand for solid wood products like construction timber has been low in the Rocky Mountains. The most lucrative wood products field is in pallet-panelling, fiber board, and specialty products.

In Colorado, the recent construction of two flakeboard mills has resulted in a great increase in demand for aspen wood from about 250 ha harvested per year to over 1000 ha/yr. In addition, Betters (1976) predicts that pallet-panel operations may expand in the central Rockies because ample amounts of sawtimber sized aspen suitable for those products are available in the region. Because about 75% of aspen stands in the central Rockies are considered mature and overmature, clearcut logging or

prescribed burning may be used as regenerative procedures to induce vegetative sprouting. The increased demand for aspen products and concern over its lack of regeneration has generated interest in determining its values for various uses. Aspen as wildlife habitat is of particular interest, because there is little information about wildlife requirements in aspen. This research problem will address the relationships of populations of wildlife species and communities with different aspen habitat types, successional stages and clearcut patterns.

PLANNED STUDIES

1. Determine wildlife species composition and abundance in aspen versus surrounding habitats.

2. Determine wildlife responses to structural variation in habitat quality of aspen, and identify predictors of habitat quality.

3. Determine how pattern and juxtaposition of seral stages within aspen stands affects wildlife distribution and abundance.

4. Determine if and how wildlife community characteristics vary in response to aspen succession.

5. Evaluate the importance of aspen stand size on animal species occurrence and abundance.

6. Identify and monitor population dynamics and activities of species that prefer aspen habitats or that are sensitive to variation to aspen habitat quality.

Studies are listed in order of priority, based on our perception of which studies will yield the most information for dollars spent. Studies 1 and 2, and 4 and 5 were designed to be run concurrently with little increase in cost or man-power. Study 3 investigates the complex relationship between wildlife habitat selection and fragmentation of aspen habitat, and is considered to be a highly valuable study because it will yield original information on a difficult, rarely-studied problem. Study 6 requires intensive investigation of individual animal species, and should be based on information derived from studies 1-5.

RATIONALE

Considerable information exists describing the occurrence and abundance of wildlife species in undisturbed aspen habitats (e.g., Reynolds 1969, Flack 1976, Armstrong 1977, Winternitz 1973, 1976, 1980, Young 1977). It is also well-known that aspen is an important browse species for big game (Patten and Jones 1977) and that clearcut logging and burning of aspen improves foraging habitat for wild ungulates by stimulating suckering (Gruell and Loope 1974, Regelin et al. 1974, DeByle in press). However, information on the response of small mammals and birds to aspen treatment is negligible. Removal of the overstory by clearcut logging has an obvious adverse impact on cavity-nesters and other wildlife species requiring a

mature aspen forest (DeByle 1981, Crouch 1981, 1983), but research is needed to understand the subtler relationships between wildlife communities and aspen seral stages, number of treatments and treatment size and shape. Land managers need such treatment information to integrate wildlife objectives with timber production and other forest management goals.

The Wildlife and Fish Habitat Relationships program of the National Forest system (Nelson and Salwasser 1982), and regional projects such as the Rocky Mountain Region's "Managing Forested Lands for Wildlife" (Hoover and Wills 1984) present wildlife models for implementing forest management plans. The proposed research for Problem 1 is designed to field test and verify the adequacy of these wildlife models in the aspen forest type by evaluating the relationships of wildlife communities and individual species to habitat types, amounts, patterns, and seral stages in aspen stands. Studies 1 and 2 will examine the influence of aspen habitat structure and proximity to surrounding coniferous forest on birds and mammals. Pure aspen stands, with or without shrub understories, and aspen conifer mixed stands with either conifer seedlings in the understory, or mature conifers in the overstory provide a wide variety of habitats for wildlife. The value of aspen as bird habitat is emphasized by Salt's (1957) study in which he found that the aspen type had at least three times the bird biomass of any of the six vegetation types censused. Flack (1976) described extensive variation in abundance and species richness of birds in the aspen ecosystem in response to large variation in habitat structure and tree species composition as well as variation in this ecosystem over its geographical and elevational range. By studying species diversity, guild

composition, and nesting behavior of wildlife in pure and mixed conifer aspen stands with varying habitat structures, we hope to fill gaps in existing knowledge.

Study 3 examines the impact of forest fragmentation on wildlife communities. Fragmentation is caused by timber harvest whereby an intact forest is converted to one containing numerous cuts of varying sizes and shapes. These patches of early seral growth may provide new habitat to some wildlife species, but extensive fragmentation may ultimately have an adverse effect on animal activity and abundance by reducing the amount of aspen habitat available for nesting and foraging.

Study 4 addresses the importance of different seral stages to wildlife communities. Early seral stages of aspen are important to some wildlife species (Buttery and Gillam 1984). The short-lived grass-forb stage is a source of forage for large ungulates and provides contrast in structure for habitat diversity. The shrub/seedling stage which is produced by suckering, supplies browse for big game and provides food for mammals such as the deer mouse, snowshoe hare, and beaver. The sapling/pole stage is uncommon in the Rocky Mountains, but where present, provides breeding, feeding and resting habitat for insectivorous birds like the warbling vireo and hiding cover for deer and elk. In addition to its importance as cavity-nesting habitat, (described below) mature and old-growth aspen supplies downed material which is valuable as cover for small rodents and as a food source for birds.

Study 5 addresses the influence of stand size on wildlife. Comparisons of species occurrence, abundance, and community structure between large and small stands will lead to the identification of minimum stand sizes necessary to meet species habitat requirements. Species that require large tracts of unbroken forest will be identified based on their presence or absence in different sized stands.

Study 6 will focus on species with specialized habitat needs. Hoover and Wills (1984) identified seven species believed to have a narrow range of ecological tolerance in aspen habitats: beaver, mountain bluebird, goshawk, McGillivray's warbler, sharp-shinned hawk, warbling vireo, and yellow-bellied sapsucker. It is our belief, however, that cavity-nesters may be the most specialized species in aspen habitats. In Colorado aspen forests, Winternitz (1980) found that 38% of the breeding species were cavity-nesters. About 34 of the 85 hole-nesting species in North America have been known to use aspen cavities (Scott et al. 1977). The aspen forest type is especially important to the following cavity-nesting species: western screech owl, yellow-bellied sapsucker, tree and violet-green swallow, house wren, and various chickadee species. Mature and old-growth aspen stands provide the best habitat for cavity-nesters because 6% to 20% of the standing trees are dead. Trees infested with decay fungi, in particular Fomes igniarius, are excavated by woodpeckers (e.g. Kilham 1979) and their cavities are later used by secondary cavity-nesters. However, an aspen snag is available to cavity-nesters for only a few years before it falls (Buttery and Gillam 1984). Because aspen provides superior (i.e. softer) wood for cavity-nesters than harder spruce and fir, aspen snags in

a mixed aspen-conifer forest probably provide essential habitat for some cavity-nesters (DeByle in press). Converting mature aspen habitat to earlier seral stages by harvesting may cause a major loss of cavity-nesting birds, particularly if treatment size is large. It is therefore essential that snag management guidelines be developed in the aspen habitat type to retain cavity-nesting habitat in forests with an aspen harvesting plan.

PROSPECTUS

General plans, durations, and costs of the planned studies are summarized on the following pages.

STUDY 1: Determine wildlife species composition and abundance in aspen versus surrounding habitats.

OBJECTIVES: Identify species that reach higher densities in aspen than in surrounding vegetation types. Based on these data, identify species that preferentially use aspen habitat and that may be considered aspen specialists, suitable for selected species studies. Identify seasons of critical use by wildlife, and status of year-round, breeding and wintering residents. Identify habitat factors that may increase or limit animal abundance in aspen. Field-test predictions of the wildlife habitat relationships program prescribed in Managing Forested Lands For Wildlife.

STUDY AREA: Study areas will be selected in national forests in Colorado and Wyoming. Four or five aspen habitat types will be chosen based on

geographic coverage, distinctness, commercial value, accessibility, and wildlife value. Study sites will be selected in mature, large-size (>100 ~~ha~~ Acre) stands representing both seral and stable aspen habitat types. Two to five replicates will be established in each habitat type (8-25 stands). These same stands will be used in Study 2 and will provide the larger-sized stands for Study 5.

STUDY MEASUREMENTS: Measures of community structure will include species richness, guild composition, distribution of abundance among guilds, consuming biomass distribution among foraging guilds, and distribution of nesting guilds. Census methods will include variable circular plots or transects for birds, and trap clusters, pitfalls, track stations, and telemetry for mammals.

ESTABLISHMENT AND DURATION: Study sites will be established in 1986, followed by 3 years of data collection. Analysis of data and preparation of manuscripts for publication will be completed in 1990.

ASSIGNMENT: Martin G. Raphael and Deborah M. Finch.

COST:

Labor:	Person days
Plot selection	400
Layout bird transects	75
Layout mammal traps	75
Collection of avian field data	450
Collection of mammal field data	900
Data entry and analysis	200
Manuscript preparation	60
	1860

Materials and Services:	Dollars
Traps, nets, stakes, etc.	15,000
Trailer space rental	3,000
Computer services	1,000
Mileage	4,500
Travel and per diem	8,250
Vehicle rental	1,000
	$32,750

STUDY 2: Determine wildlife responses to structural variation in habitat quality of aspen, and identify predictors of habitat quality.

OBJECTIVES: Determine importance of different aspen habitat types to wildlife. Detect variation in wildlife population dynamics in response

to variation in habitat structure and plant species composition. Identify habitat variables that predict habitat quality and animal species occurrence.

STUDY AREA: Study areas will be identical to those established in study 1. Stable habitat types will include Aspen/Serviceberry/Chokecherry, Aspen/Serviceberry, and Aspen/Ligusticum; seral habitats will include Aspen/ Blue Spruce and Aspen/Spruce-fir/ Elk sedge.

STUDY MEASUREMENTS: Habitat structure will be evaluated by sampling vegetation on quadrats or circular plots. Structural measurements will include vertical and horizontal heterogeneity, tree size, tree density, foliage distribution, downed wood volume and plant species composition. Wildlife census methods will be identical to those in Study 1.

ESTABLISHMENT AND DURATION: This study will be established concurrently with Study 1, and data analysis and preparation of manuscripts should be completed by 1990.

ASSIGNMENT: Deborah M. Finch and Martin G. Raphael

Cost:

Labor:	Person days
Establishment of vegetation plots	60
Collection of habitat field data	450
Data entry and analysis	200
Preparation of manuscripts	60
	770

Materials and Services	Dollars
Equipment for measuring vegetation	2,000
Computer services	1,000
Mileage	750
Travel and per diem	2,100
Vehicle rental	500
	$6,350

STUDY 3: Determine how pattern and juxtaposition of seral stages within mature aspen stands affects wildlife distribution and abundance.

OBJECTIVES: Determine how the landscape-level changes caused by fragmentation of aspen stands affects wildlife diversity and species distributions. Determine if a species' abundance in a given seral stage is independent of juxtaposition with other seral stages. Determine the effect of arrangements of harvest cuts, cut shape and size, timing of cut, and extent of cut on wildlife. Compare rates of wildlife colonization of

early seral vegetation to predictions from island biogeographic theory. Compare study results with predictions provided in Managing Forested Lands for Wildlife.

STUDY AREA: At least six large (>200 ha) intact aspen stands will be selected in the central Rocky Mountains. Two years of pre-treatment data will be collected. Two stands will then be partially cut (approx. 25% timber removed) and two stands will be heavily cut (approx. 50% timber removed). Two uncut stands will serve as controls. Post-treatment data will be gathered for an additional two years, following one year of treatment.

MEASUREMENTS: Wildlife populations will be censused using the spot-mapping method (birds) and telemetry (mammals). Changes in animal abundance, nest site selection, and foraging behavior among treatments, will be examined as well as the influence of size and shape of cut on population size and distribution. Habitat edge characteristics (e.g., surface area relationships) will be measured and correlated to wildlife abundance patterns.

ESTABLISHMENT AND DURATION: Study plots will be established in 1986. Pre-treatment data will be gathered in 1987 and 1988, followed by a treatment year (1989) and two years of post-treatment data collection. Data analysis and preparation of manuscripts should be completed by 1992.

ASSIGNMENT: Martin G. Raphael

Cost:

Labor:	Person days
Plot selection and establishment	80
Collection of field data	800
Data entry and analysis	200
Preparation of manuscripts	60
	1,140

Materials and Services:	Dollars
Censusing and trapping equipment	7,000
Maps and aerial photos	100
Computer services	800
Mileage	3,000
Travel and per diem	2,200
Vehicle rental	2,000
	$13,100

STUDY 4: Determine if and how wildlife communities vary in response to aspen succession.

OBJECTIVES: Compare wildlife community composition and structure among shrub-seedling, sapling-pole and mature stages of aspen. Determine which stages are preferred by each wildlife species for resting, feeding, and breeding, and identify the ecological basis for those

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preferences. Identify species that are sensitive to aspen succession. Evaluate the habitat capability ratings provided in the publication, Managing Forested Lands For Wildlife by comparing them to collected data.

STUDY AREA: At least 10 study stands will be established in each of two seral stages: shrub-seedling and sapling-pole. These will be compared to the mature stages sampled under studies 1 and 2.

STUDY MEASUREMENTS: Wildlife populations will be censused using techniques described in studies 1 and 2. Habitat variables to be examined are seral type, size, and shape of seral stand and habitat structure of each seral stage. Number of clearcut patches and juxtaposition of patches are variables measured in study 3 that are also relevant to this study.

ESTABLISHMENT AND DURATION: Study plots will be established in 1986, concurrently with studies 1 and 2. Data analysis and preparation of manuscripts should be completed by 1990.

ASSIGNMENT: Deborah M. Finch

COST:

Labor:	Person days
Establishment of study sites	125
Collection of field data	720
Data analysis	160
Preparation of manuscripts	50
	1055

Material and Services:	Dollars
Traps, nets, stakes, etc.	6,800
Trailer space rental	1,200
Computer services	800
Mileage	480
Travel and per diem	4,140
Vehicle rental	600
	$14,020

STUDY 5: Evaluate the importance of aspen stand size on animal species occurrence and abundance.

OBJECTIVES: Compare species occurrence, abundance, and community structure between large and small stands. Identify wildlife species that are most sensitive to stand size (used as a criterion in Study 6). Determine minimum stand size needed by sensitive species based on analysis of colonization and extinction rates of each species in each stand.

STUDY AREA: Three stand sizes of approximately 10 ha, 100 ha, and 1000+ ha will be selected in aspen stands of the central Rockies. Studies 1 and 2 will provide the two larger stand sizes. Study 5 will require the addition of 10-20 smaller stands.

STUDY MEASUREMENTS: Wildlife abundance and species richness will be sampled using the procedures described in Studies 1 and 2. Other variables to be measured are stand size, stand isolation, and species colonization and extinction rates.

ESTABLISHMENT AND DURATION: Study sites will be established in 1986, concurrently with studies 1 and 2. Data analysis and preparation of manuscripts should be completed by 1990.

ASSIGNMENT: Deborah M. Finch

COST:

Labor:	Person days
Establishment of sampling plots	125
Collection of field data	720
Data analysis	160
Preparation of manuscripts	50
	1,055

Materials and Services:	Dollars
Traps, nets, stakes, etc.	6,000
Trailer space rental	1,200
Computer services	800
Mileage	480
Travel and per diem	4,140
Vehicle rental	600
	$14,070

STUDY 6: Identify and monitor population dynamics and activities of species that prefer aspen habitats or that are sensitive to variation in aspen habitat quality.

OBJECTIVES: Identify reasons why selected species prefer aspen over other habitats. Determine the underlying basis for habitat selection within aspen by relating activity budgets to resources, habitat structure, and interspecific interactions. Verify sensitivity of selected species to aspen harvest. Determine if, how, and why some species are selective of seral stages or stand sizes. Measure the population dynamics of sensitive species over time and habitat type. Develop guidelines to manage these species.

STUDY AREA: Selected species will be studied on a subset of the study plots established in Studies 1-5.

STUDY MEASUREMENTS: Candidates for study will be species that are 1) abundant enough to sample and for which adequate study techniques exist, 2) identified in studies 1-5 as strongly associated with aspen, 3) potentially sensitive to aspen management, and 4) listed as management indicator species. Among factors to be measured are microhabitat features needed for foraging, resting, nesting, etc.; food availability and diet; reproduction and survival; and activity budgets.

ESTABLISHMENT AND DURATION: This study will begin in 1988 after preliminary sampling in 1986-87 to determine sensitive species. Manuscripts should be completed by 1991.

ASSIGNMENT: Martin G. Raphael and Deborah M. Finch

COSTS: Cost of these studies cannot be determined without prior sampling and identification of selected species. Costs will range from $10-25,000 per year per species.

COOPERATION AND COORDINATION

Research Work Unit-RM-1712 (this unit) will cooperate extensively with Research Work Unit-RM-1252 (Multiresource Management of Montana and Subalpine Zones in the central Rocky Mountains) in Fort Collins in the planning and conducting of aspen studies. Biologists in the National Forest system will be contacted for advice on establishing study sites. Information from our studies will be used to test habitat capability

ratings developed by the Colorado Division of Wildlife and the U.S. Forest Service Rocky Mountain Region, and cooperation with these agencies will be maintained to maximize benefit. Concurrent studies of big game species will be encouraged through the Wyoming Department of Game and Fish and Colorado Divison of Wildlife.

Communication with scientists from colleges and universities as well as with personnel from other federal and state agencies will be established to minimize duplication of effort and to ensure data and technology transfer. When we lack personnel to undertake studies ourselves, cooperative agreements will be offered to scientists from outside the Rocky Mountain Forest and Range Experiment Station.

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